Chapter 4. Foods + Nutrition.

All living things composed of protoplasm.
- contained in cells.
- constitutes tissues + organs of body.
- chief constituents are.
  - proteins
  - carbohydrates
  - fats
  - inorganic salts, water.
  - fatlike compounds - lipoids.

Proteins - essential constituents of protoplasm.
- contain C. O. H. N. (P. Fe)
- compounds derived are amino acids, which may be absorbed directly into the blood stream.
- proteins essential for growth.

Carbohydrates contain - C. H. O. sugars, starch
sugars - corn syrup - soluble in water.
starches - breads, potatoes etc.
- insoluble in water.
- stored as glycogen.
- carbon hydrates readily oxidized.

Fats - butter, cream etc.
- compounds of C. H. O. but in different proportion from proteins.
- composed of fatty acids + glycerol.
- not soluble in water.
- stored in body.

Lipoids - resemble fats, but also contain phosphorus & nitrogen. lecithan, cholesterin

Inorganic salts - chlorides, nitrates etc. found in solution.

Water - comprises 65-90% of cell.

Enzymes - organic catalysts.
- hasten chemical reactions
- affected by heat & cold.

Physical properties.

Diffusion - dispersion of molecules of one substance through another.

Osmosis - passages of water & substances in solution through membrane.

Metabolism - process of a cell - is protoplasm breaking down & being reconstructed.
- chemical processes contributing to all activities of protoplasm

Anabolism - building up & replacement of protoplasm.

Katabolism - process by which the protoplasm is broken down to liberate energy.

When anabolism is in excess of katabolism, organs grow.

Reverse - organs decline.

Digestive System.

Alimentary Canal - 4 parts.

1. mouth & esophagus.
2. stomach
3. small intestine.
4. large intestine.

(appendix leads out of small intestine)

Mechanical & chemical processes going on at the same time.

Alimentary Tract - long tube - begins at mouth, ends at opening of large intestine.

- Food is eventually absorbed into blood stream & not until then is it part of the body.

Mouth - mechanical act of chewing.

- chemical act of moistening the food with saliva.
- saliva converts starch of carbohydrates into sugar.

Stomach - muscular sac.

- food stored in fundus on left side.
- esophagus enters on left, small intestine leaves of right.
- cardiac end - left.
- pyloric end - right.
- stomach walls - mostly muscle.
- walls contain glands which secrete gastric juice.

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- 3 layers of muscle running circularly, obliquely, longitudinally.
- performs peristalsis.
- juice allows proteins to split into proteoses & peptones, which go through pyloric valve into small intestine for digestion.

Gastric digestion -

1. - vegetable food softened.
2. - food mixed with fluid - chyme.
3. - chemical action, resulting in splitting of proteins into peptones & proteoses.

At intervals pyloric valve opens & chyme is discharged into intestine, by peristaltic - contractions waves of the stomach walls.

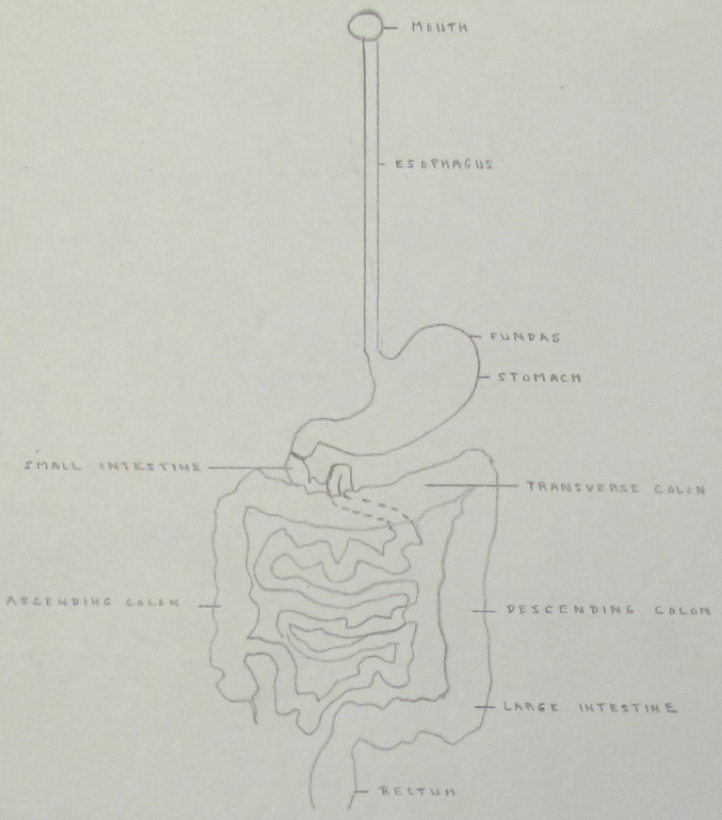
Small intestine.

- has 2 coats 1) muscular coat.
  2) glandular mucous
- lined with intestinal villi.
- 20 - 25' in length.
- glands pour out juices constantly.
- contains intestinal juice.
- pancreatic & bile enter here.

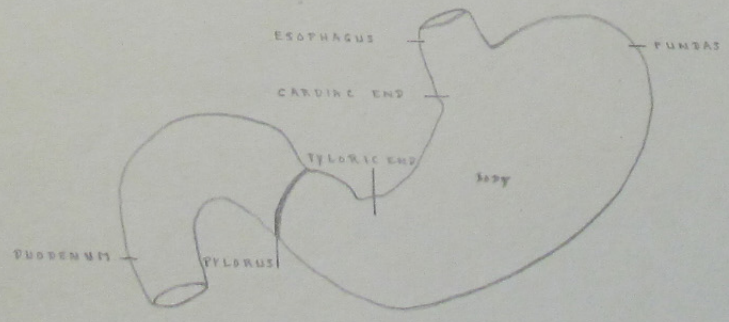
Large intestine -

- receives indigestible material.
- foods escaping digestion.
- chiefly excretory organ.
- ascending colon - absorption of water.
- intestinal bacteria act on peptones & peptides.

ALIMENTARY CANAL



STOMACH



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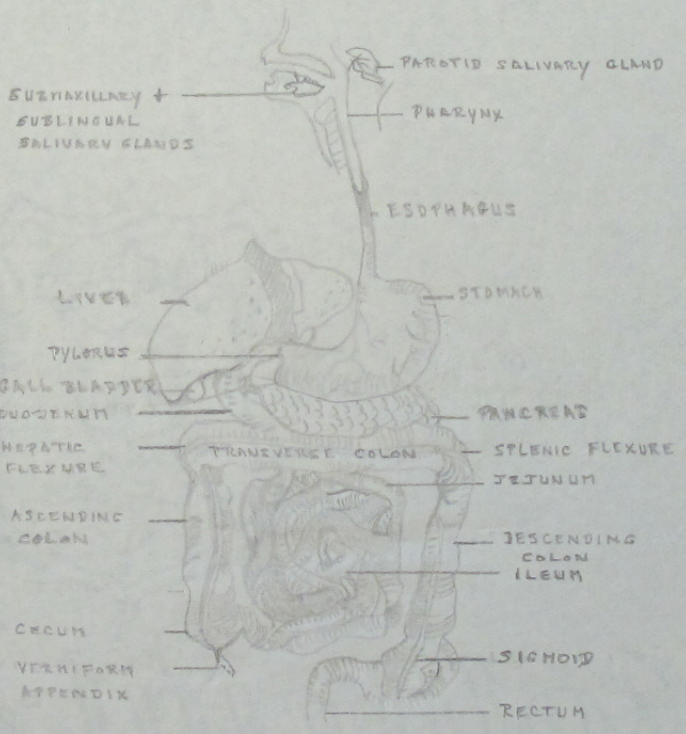
THE DIGESTIVE ORGANS.



Enzyme.	Act on.	Action.
ptyalin	cooked starch	starch into maltose
pepsin	proteins	proteins into proteoses & peptones.
rennin	protein of milk	curdles milk.
lipase	small fat globules	dissolves fat.
trypsin	proteins	peptides.
amalopsin	carbohydrates	maltose
steapsin	fats	fatty acids & glycerine
erepsin	peptides	amino acids
maltase	maltose	dissachrides.
lactase	lactose milk sugar	glucose & galactose
sucrase	cane sugar	glucose molecules.
lipase	fats	fatty acids & glycerine.

Proteins - proteoses & peptones (pepsin) - peptides (trypsin) / amino acids (erepsin).

Carbohydrates.
- starch - maltose (ptyalin + amalopsin) - ~~maltose~~ / maltase ~~disaccharides~~ disaccharides.
- lactase - lactose - glucose & galactose.
- sucrase - cane sugar - glucose mol.

Fats - fat globules (lipase) - disolve - fatty acids + glycerine (steapsin & lipase).

Solvent	Ferment	Action
Mouth -		
saliva	ptyalin	starch into maltose.
Stomach - gastric juice	pepsin	proteins to p + p.
	rennin	curdles milk
	lipase	dissolves fat.
Intestine -		
pancreatic juice	trypsin	proteins into peptides
	amalopsin	carb. into maltose
	steapsin	fats - fatty acids + glycerine
	rennin	curdles milk.
intestinal juice	erepsin	peptides - amino acids
	maltase	maltose - disaccharides
	lactase	lactose - glucose
	sucrase	cane sugar
	lipase.	fats - fatty acids + glycerine

Changes of Food Material.

Mouth - saliva - ptyalin.
Carbohydrates - cooked starch to maltose.
Stomach - gastric juice -
Proteins - peptones & proteoses by pepsin.
Fats - fatty acids & glycerol by lipase.
Milk - curdled by rennin.
Intestine - pancreatic juice.
Proteins - peptids by trypsin.
Starches - maltose by amalopsin
Fats - fatty acids & glycerol by steapsin.
Milk - curdled by rennin.
- intestinal juice.
Proteins - amino acids by erepsin. Starches - disaccharides by maltase.

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ORGAN	WHERE PRODUCED	DIGESTIVE JUICES & IMPORTANT ENZYMES	ACTS UPON	RESULTING PRODUCTS	SUBSTANCE ABSORBED
Mouth	Salivary glands	1. Saliva a) Salivary amylase (ptyalin)	Starch	Malt sugar	None
Stomach	Stomach lining	(Ptyalin continues) 2. Gastric juice a) Rennin b) Pepsin (gastric protase) + hydrochloric acid)	Milk protein Proteins	Milk curds Proteoses and peptones	Practically none (except alcohol)
Small Intestine	Liver	3. Bile (contains no enzymes)	Large fat droplets	Emulsified fats	Amino acids simple sugars fatty acids glycerol vitamins salts.
	Pancreas	4. Pancreatic juice a) Trypsin - pancreatic protease	Proteins	Proteoses, peptones, peptids, AMINO ACIDS	
		b) Steapsin - pancreatic lipase	Emulsified fats	FATTY ACIDS, GLYCEROL	
		c) Amylopsin - pancreatic amylase	Starch	Malt sugar	
	Intestinal Lining	5. Intestinal juice a) Erepsin - a protease	Proteins	AMINO ACIDS	
		b) Sucrase - invertase	Cane sugar	GLUCOSE, FRUTOSE	
		c) Maltase	Malt sugar	GLUCOSE	
		d) Lactase	Milk sugar	GLUCOSE, GALACTOSE	
Colon	None		A little undigested food		Water

CAPITOLS INDICATE END PRODUCTS OF DIGESTION

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ENZYMES EMPLOYED IN DIGESTION.

Digestion

In mouth food mixed with saliva.
- comes from 3 sets of salivary glands.
1) parotids - in front of & below ear.
2) sublingual - under tongue
3) submaxillary - under jaw at base of tongue.

Saliva contains enzyme ptyalin (an amylolytic)
- converts carbohydrates into sugar.
- amylolytic - starch - splitting enzyme.
- fats & proteins unchanged.

ptyalin - turns cooked starch into maltose.
- sense of taste reflexly stimulates secretion of gastric juice in stomach.

Food travels by peristaltic waves to stomach.

In Stomach - muscular coat lined by a thin membrane containing
gastric glands, mostly in pyloric end.
Secrete gastric juice containing 3 ferments.
1) pepsin
2) rennin
3) lipase HCl.

pepsin - breaks proteins into proteoses & peptones.
- need acid medium (HCl)

HCl - breaks down meats so pepsin can get at it.

rennin - curdles protein of milk.

lipase - dissolves fat in small globules.
eg. (egg-yolks, cream)

Gastric juice won't flow when
1) food is distasteful.
2) mind not at rest.